

CONTRIBUTIONS FROM THE
LOS ANGELES MUSEUM - CHANNEL ISLANDS
BIOLOGICAL SURVEY

9. A RARE MYRIAPOD FROM ANACAPA ISLAND,
COMPARED WITH TWO TEXAS SPECIES

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The Anacapa Island Expedition of August, 1940, turned up a little colony of creatures, looking like Dermestid larvae, which set the writer's heart into high speed, for only twice before in over 40 years of collecting had he ever seen any other specimens of the rare Diplopod genus *Polyxenus* Latreille (1802), which is classed in the family Polyxenidae, order Schizocephala, sub-class Pselaphognatha, class Diplopoda, superclass Myriapoda, phylum Arthropoda.

The type of Latreille's genus, *Polyxenus lagurus* Linnaeus, is the only species known from Europe; *P. fasciculatus* Say (1817) is the only species known from the United States, while *P. longisetis* Pocock (1894) from Cuba, is questionably referred to the genus. In Hawaii there are two species, one probably erroneously referred to *P. fasciculatus*, and the other *P. hawaiiensis* Silvestri. There are several other genera in the family, with species mostly from Africa, and a few from Central America and the West Indies.

In the writer's collection from Texas are 13 specimens from two localities, and on close examination for the first time, it is concluded that they represent two distinct species, both differing materially from the new Island form.

Close microscopic study reveals startling relationships to the insects. It is quite possible that someone has noted this relationship, but it has never come to the writer's attention that anyone has correlated the diplopod segmentation with insect segmentation; nor has he seen any suggestion of a differentiation of thorax and abdomen.

Polyxenus most definitely has a head, a cervical segment (sometimes called the first segment), three thoracic segments each bearing one pair of legs; five abdominal segments with two pairs of legs each; and two terminal segments without legs; the last bearing two brushes of bristles instead of cerci. Viewed ventrally each pair of legs belongs to a sternal segment with a definite sternite, so that we may definitely conclude that the abdominal tergites are coalesced doublets. We should probably place the Diplopoda and Pauropoda as higher developments than the Chilopoda.

In the following table the segmentation and appendages of Polyxenus, Machilis, Protura, and normal primitive insects is suggestive of a phylogenetic trend.

CORRELATION OF PRIMITIVE SEGMENTATION IN POLYXENUS AND INSECTS

POLYXENUS			MACHILIS		PROTURA		PRIMITIVE INSECTS	
Tergites	Sternites	Appendages	Sternites	Appendages	Sternites	Appendages	Sternites	Appendages
Head Cervix	Head Cervix	Mouth	Head Cervix	Mouth	Head Cervix	Mouth	Head Cervix	Mouth
Pro-notum Meso N. Meta N.	Prosternum Meso St. Meta St.	Legs I II III	Prosternum Meso St. Meta St.	Legs I II III	Prosternum Meso St. Meta St.	Legs I II III	Prosternum Meso St. Meta St.	Legs I II III
Abdom. Terg.	Abdom. Stern.	Legs	Abdom. Stern.	Styli	Abdom. Stern.	Styli	Abdom. Stern.	None
I	I	IV	I	I	I	I	I	
II	II	V	II	II	II	II	II	
III	III	VI	III	III	III	III	III	
IV	IV	VII	IV	IV	IV	IV	IV	
V	V	VIII	V	V	V	V	V	
VI	VI	IX	VI	VI	VI	VI	VI	
IV	VII	X	VII	VII	VII	VII	VII	
V	VIII	XI	VIII	VIII	VIII	VIII	VIII	
VI	IX	XII	IX	IX	IX	IX	IX	
VI	X	XIII	X	X	X	X	X	
VII	XI		XI	XI	XI	XI	XI	
VII	XII				XII			
Totals 12	17	13	16	9	17	6	16	3

The development of *Polyxenus* is anamorphic, segments being added in each instar between the preanal segment and the preceding abdominal segment. Whether there is a hexapod stage as in *Pauropus* remains to be determined, but it is suggested below. *Pauropus* is placed in the class Pauropoda at the bottom of the Myriapod scale, but should probably belong near the *Pselaphognatha* and *Insecta*, for it too has thoracic segments with a single pair of legs, and abdominal segments with two pairs of legs. Its first larva has only 3 thoracic pairs of legs, and the succeeding stages have successively (4?), 5, 6, (7?), 8 and 9 pairs of legs, presumably adding one sternite at a time.

At first it seemed that *Polyxenus* adds two sternites bearing legs at a moult, but we have one specimen with 10 pairs, and six with 12 pairs, so it may be that a single sternite is added each moult.

ANAMORPHOTIC DEVELOPMENT OF POLYXENUS

LARVAL STAGES										ADULT	
STAGE I		STAGE II		STAGE III		STAGE IV		STAGE V		Terg.	Legs
Terg.	Legs	Terg.	Legs	Terg.	Legs	Terg.	Legs	Terg.	Legs		
Head		Head		Head		Head		Head		Head	
Cervix		Cervix		Cervix		Cervix		Cervix		Cervix	
Pro N.	I	Pro N.	I	Pro N.	I	Pro N.	I	Pro N.	I	Pro N.	I
Meso N.	II	Meso N.	II	Meso N.	II	Meso N.	II	Meso N.	II	Meso N.	II
Meta N.	III	Meta N.	III	Meta N.	III	Meta N.	III	Meta N.	III	Meta N.	III
		Abd. I	IV	Abd. I	IV	Abd. I	IV	Abd. I	IV	Abd. I	IV
			V		V		V		V		V
				Abd. II	VI		VI		VI	II	VI
					VII		VII		VII		VII
							VIII	III	VIII	III	VIII
							IX		IX	IV	IX
								IV	X	IV	X
									XI	V	XI
Preanal		Preanal		Preanal		Preanal		Preanal		Preanal	
Anal		Anal		Anal		Anal		Anal		Anal	
											XII
											XIII

Specimens are at hand belonging to stages II, III, IV, V, and adult; and we merely assume that there may be a first larva of the same type as in the Pauropoda. If we are right in this assumption, the Pauropoda and Schizocephala are primarily hexapod, but unlike the majority of insects develop more legs in successive instars. Anamorphosis also occurs in the Proturan insects, which have stages with nine, ten, eleven and twelve abdominal segments.

The legs of Polyxenus are very similar in form to those of the Protura, consisting of Coxa, Trochanter I and III, Femur, Tibia, Tarsus, and Pretarsus (claw), while in Protura there is but one Trochanter.

In most insects the tarsus is divided into 2 to 5 segments but primitive insects and many larvae of higher insects have only one tarsal segment; the pretarsus is usually reduced to a claw or claws. The trochanters are usually fused in insects into a single piece; but in larvae, such as the Coleopterous *Exema jenksi*, there are two trochanter segments, just as in Polyxenus.

A KEY TO THE SPECIES OF POLYXENUS IN THE UNITED STATES

1. Antennae short, sixth joint not one-half longer than wide;
sternellum triangular 2

Antennae longer, exceeding the bristles of the vertigial crown, sixth joint over twice as long as wide; finer tail bristles with single backward barb, faced by a forward pointing barb; dorsal bristles never showing more than three rows of spines at one view; presternum and sternellum broadly arcuate: West Texas.....3. *tuberculatus* n. sp.

2. Body light brown, head with darker coronal band, but no median band; bristles cinereous; the finer tail bristles with single backward barb, faced by a forward pointing barb; dorsal bristles never showing at one view more than three rows of spines; presternum usually divided into subtriangular parts: South Texas.....1. *fasciculatus* Say
race *victoriensis* n. race

Body dark brown, head with dark coronal and median bands; bristles snowy white; the finer tail bristles with 2 to 5 (mostly 3) backward barbs; dorsal bristles showing at one view five to six rows of spines; presternum triangular and small; legs stout: Anacapa Island, California.....
.....2. *anacapensis* n. sp.

COMPARISON OF THE ANTENNAE OF THE THREE SPECIES OF
POLYXENUS OF U. S.

Segment	LENGTH OF JOINTS (1 space=0.017 mm.)			BREADTH OF JOINTS		
	Fascic.	Tuberc.	Anacap.	Fascic.	Tuberc.	Anacap.
1	5	3	4	3	2.5	3.5
2	2	3	3	3	2.5	3.5
3	1	1	2	3	2.5	3.5
4	2	3.5	3	3	2.5	3.5
5	1.5	3	2	3	2.75	3
6	4	7	4.5	3.5	3	3.5
7	2.5	2.5	3.5	2.25	2.25	2.5
8	1	2	1	1.5	1.5	1.5
	19.0	25.0	23.0			

Relatively the segments are to each other in about the same proportions in the three species, but the sixth segment is not one-half longer than wide in *fasciculatus* and *anacarpensis*, and is over twice as long as wide in *tuberculatus*. The antennae of *anacarpensis* are stouter, and those of *tuberculatus* longer than the others.

1. POLYXENUS FASCICULATUS Say.

Pollyxenus fasciculatus Say. 1821. Journ. Acad. Nat. Sci., Phila., 2:108.

Say's original description is as follows:

"Genus *Pollyxenus* Latr.

"Body membranaceous, penicillate with setae at tip; antennae inserted under the anterior margin of the head.

"*P. fasciculatus*: Body pale brown, linear, incisures ciliated fasciculated each side; head deeply ciliated before.

"Inhabits the Southern States.

"Segments smooth, ciliate at the incisures, and fasciculate with brown setae each side, terminal pencils cinereous; head semi-orbicular, depressed, deeply and densely ciliated on the edge with setae; eyes small, oval, prominent, placed obliquely in the middle of the lateral margin; antennae very short, thick reddish brown; feet white.

"Length rather more than one-tenth of an inch.

"Beneath stones, etc., in humid situations; not very common."

There are at hand six specimens, mounted one to a slide (slide 5 also has 7 cast skins), from a larger collection made by J. D. Mitchell, at Victoria, Texas, March 2, 1910, under Hunter No. 1861, found as a colony in a Lepidopterous cocoon. The remainder of the series is no doubt in the collections of the U. S. National Museum, but one of these slides is also to be deposited in that Museum.

These specimens agree with Say's description and are here described in detail. Say does not give a type locality, and may possibly have been dealing with a different species; but if his specimens are not now extant, we may consider the present description as a redescription. In order that there may be no doubt as to the identity of the material here described, it is given the race name *victoriensis*, which would become its species name if it is different from Say's species.

Polyxenus fasciculatus Say, race *victoriensis*, new race (figs. 1, 4, 7, 10, 11, 12, 13, 19).

Type locality, Victoria, Texas.

In this small series it was possible only to rather indefinitely correlate size with stage, other than length of body. The head measurements of the 4th and 5th stages seem to be practically identical.

Stage 4: 9 pairs of legs; length of body 1.003-1.581 mm. from tip of head to attachment of tail bristles; breadth of head at eyes 0.544-0.56 mm.; length of head from line connecting the occipital emarginations behind eyes 0.255-0.272 mm.

Stage 5: 11 pairs of legs; length of body 1.87-2.04 mm.; breadth of head 0.56-0.569 mm.; length of head 0.272 mm. (fig. 19).

Head broadly rounded in front; abruptly and strongly emarginate behind eyes by the occipital suture; the vertex is ornamented anteriorly with two broadly rounded rows of setigerous punctures, outlining a dark brown band, behind which the vertex is lighter and semicircular. Each bristle borne on a slender peduncle is elongate, clear, and bears three visible rows of sharp spines. Eye spots dark, with at least 3 clear, separated lenses. Antennae attached under over-hanging vertex, their points of attachment closer together than to eyes; eight-jointed, the first largely in its fossa, the second to fifth transverse, the sixth stout, longer than broad, and the largest of the segments, the seventh, longer than broad, eighth a very small transverse segment with apical papillae, all in the proportions given in the table. The mouthparts are hard to see, but there are two dentate edges visible, as shown in figure 1.

Dorsally the cervix is a transverse plate outlined by a narrow ellipse of stout bristles, shorter than the vertigial crown bristles of the head, each armed with three visible longitudinal rows of spines, and transversely minutely striate; laterally it is very narrow and ventrally is concealed by the mouthparts (figs. 11, 12).

The thoracic segments dorsally bear two rows of bristles pointed ventrally, of the same type as on the cervix, the anterior row being sparser; and laterally are tuberculate and armed with a cluster of spines, longer than the dorsal spines.

The abdominal segments are dorsally and laterally armed as the thoracic segments.

The anal segment is provided with two dense brushes, almost contiguous at base, of bristles which are of varying sizes, but many are much longer than the tubercular bristles, and they are of two distinct types intermingled, some appearing gray, due to the fine transverse striation. The heavier bristles are like the tubercular and dorsal bristles, with three visible rows of spines. The finer bristles are unique in form, with two more or less alternating series of lateral teeth, and near the tip a long proximal spine directed at a more distal recurved and longer spine, and beyond the end of this is a very delicate deciduous piece with long backward barb. (See figs. 12, 13.)

Ventrally the thoracic sternites correspond with the tergites, but there are two abdominal sternites for each tergite, except the preanal and anal. Each sternite of thorax and abdomen, except the cervical, preanal and anal, bears a pair of legs, which consist of coxa, first and second trochanter, femur, tibia, tarsus and pretarsus, which is a claw. Each leg-bearing sternite consists of two anterior presternal plates narrowly separated from the posterior triangular sternellum, by a commissure uniting the two lateral parts of the basisternum, at the outer ends of which the coxae are posteriorly attached (see fig. 4).

2. *POLYXENUS ANACAPENSIS* n.sp. (figs. 2, 6, 9, 15, 16, 17, 18, 19)

Described from 102 specimens of various instars and 52 cast skins, the whole series mounted on 50 numbered slides, all but slide 35 collected under bark of Eucalyptus, in colonies, August 22, 1940, on Middle Anacapa Island, California, by Chris Henne and Don Meadows (L. A. Museum No. 1940-1963); slide 35 collected on pods of *Astragalus miguuelensis*, August 18, 1940, on West Anacapa Island, by George P. Kanakoff (L. A. Mus. No. 1940-2121).

Some of the material was killed in alcohol, and the bodies are expanded; but the majority shrivelled in dying, so that body lengths are of value only in comparing those in the same condition. The specimens might even be taken for different species. In handling these beautiful little creatures one must use great

care to preserve the bristles in position. The moment they are put into a liquid the spines are whirled away, as their point of attachment is very slender.

Stage 2: 8 dorsal segments; 5 pairs of legs; length of body to attachment of caudal brush 0.425-0.442 mm.; breadth of head 0.306-0.340 mm.; length of head from line connecting occipital emarginations behind eyes 0.153-0.170 mm.; 2 specimens measured (fig. 16).

Stage 3: 9 dorsal segments; 7 pairs of legs; length of body 0.595 mm.; breadth of head 0.357 mm.; length of head 0.170 mm.; 1 specimen.

Stage 4: 10 dorsal segments; 9 pairs of legs; length of body 1.003 mm.; breadth of head 0.459 mm.; length of head 0.204 mm.; 1 specimen.

Stage 5A: 11 dorsal segments; 10 pairs of legs; length of body 1.122 mm.; breadth of head 0.442 mm.; length of head 0.187 mm.; 1 specimen.

Stage 5B: 11 dorsal segments; 11 pairs of legs; length of body 1.122 mm.; breadth of head 0.493 mm.; length of head 0.154-0.238 mm. (mean 0.196 mm.); 2 specimens.

Stage 6A: 12 dorsal segments; 12 pairs of legs; length of body 1.275-1.462 mm. (mean 1.377 mm.); breadth of head 0.493-0.527 mm. (mean 0.521 mm.); length of head 0.221-0.238 mm. (mean 0.231 mm.); 6 specimens.

Stage 6B: 12 dorsal segments; 13 pairs of legs; length of body 1.105-3.315 mm. (mean 1.384 mm.); breadth of head 0.476-0.663 mm. (mean 0.538 mm.); length of head 0.187-0.289 mm. (mean 0.241 mm.); 58 specimens measured.

While the material in some instars is insufficient to draw a final conclusion, a charting of the mean head width shows not only that the mean head width conforms with Dyar's Growth Law, but also indicates that there is a moult for each pair of legs, rather than for each two pairs, or single tergite (fig. 19).

Color yellowish to dark brown, with dark bands on head connecting eyes, and on vertigial margin, and a longitudinal median band which divides in front, making five light areas on head; each segment with dark band except at middle; all punctures light and round; vestiture of silvery white bristles, legs tinged with reddish brown.

In vestiture the pattern is as in the other species, but the spines are very different. The coronal and dorsal bristles look like elongate spiny cucumbers, with five to six rows of spines visible at one view (fig. 18); the lateral clusters of bristles are longer, and some are spined only on the sides, some have a

middle row of spines also. The tail bristles are very remarkable, of three types, coarse spiny bristles similar to the lateral ones; very fine toothed bristles with a 3, 4 or 5-backward pointed barbed apex; and fine bristles made up in the most complicated way, of deciduous whorls of distally pointing barbs (fig. 9).

The antennal joints are longer than in *fasciculatus*, but with the joints in about the same proportion, though stouter (fig. 2). The head is not sharply emarginate at occipital suture behind eyes.

The face is convex, with antennal scrobes diagonal, separated at bases by 10/35 the width of the head at the eyes, and extending from base to the eyes, thus outlining the frons.

Eyes prominent, almost acute, with at least five separate ommatidia. Two small spots near the eyes may be ocelli.

The anal segment is ridged medianly between the brushes.

The genitalia are borne on the preanal segment.

3. POLYXENUS TUBERCULATUS n. sp. (figs. 3, 5, 8, 14, 19)

Described from 7 specimens, mounted on 4 slides, taken among many others in a colony on *Tillandsia recurvata*, on live oak at Sabinal, Texas, April 1, 1910, by W. Dwight Pierce and F. C. Pratt. The remainder of the series is no doubt in the collections of the United States National Museum, but a paratype slide will be deposited in that Museum.

Stage 4: 9 pairs of legs; length of body to attachment of tail bristles 2.75 mm.; breadth of head at eyes 0.493 mm.; length of head from occipital emargination 0.238 mm. This specimen unduly expanded.

Stage 5: 11 pairs of legs; length of body 2.21, 2.227, 2.244, 2.38 mm.; breadth of head at eyes 0.459, 0.51, 0.561, 0.595 mm. (mean 0.53); length of head 0.255, 0.272, 0.289, 0.289 mm.

Adult: 13 pairs of legs; length of body 3.009, 3.060 mm.; breadth of head at eyes 0.68, 0.85 mm. (mean 0.76); length of head 0.323, 0.425 mm.

There are no essential differences in the instars, other than the number of abdominal leg-bearing segments, and the body measurements and proportions (fig. 19).

The head is hemispherical to the occipital emargination behind the eyes, and has a vertigial crown of dark and light golden bristles, which are very similar to those of *fasciculatus*. The antennae considerably exceed these spines, and are characterized by the elongate sixth joint, the proportions being as given in the table (fig. 3).

The cervix has an oval arrangement of bristles, which have only three visible rows of spines, and each successive segment has a sparse anterior and closely set posterior row of bristles, as well as a cluster of larger bristles on the lateral tubercles. The tail brush is very dense and consists of two kinds of bristles; one similar to the lateral bristles; the other finer and very complicated, similar to the corresponding bristles of *fasciculatus*, but more slender stemmed, with the barbs farther apart, and with a very similar apical armature (fig. 8).

The sternum differs from that of *fasciculatus* by having both presternum and sternellum broadly rounded (fig. 5).

LIST OF ILLUSTRATIONS

Drawings and photomicrographs by the author.

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- Fig. 4—Sternal view of one abdominal doublet of *P. fasciculatus victoriensis* (PS = presternite, S = sternellum, BS = basisternite, P = pleurum).
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- Fig. 18—Dorsal bristles of *P. anacapis*, greatly enlarged. Actual length of a bristle about 0.085 mm.
- Fig. 19—Correlation between instars and breadth of head. Dyar's law.

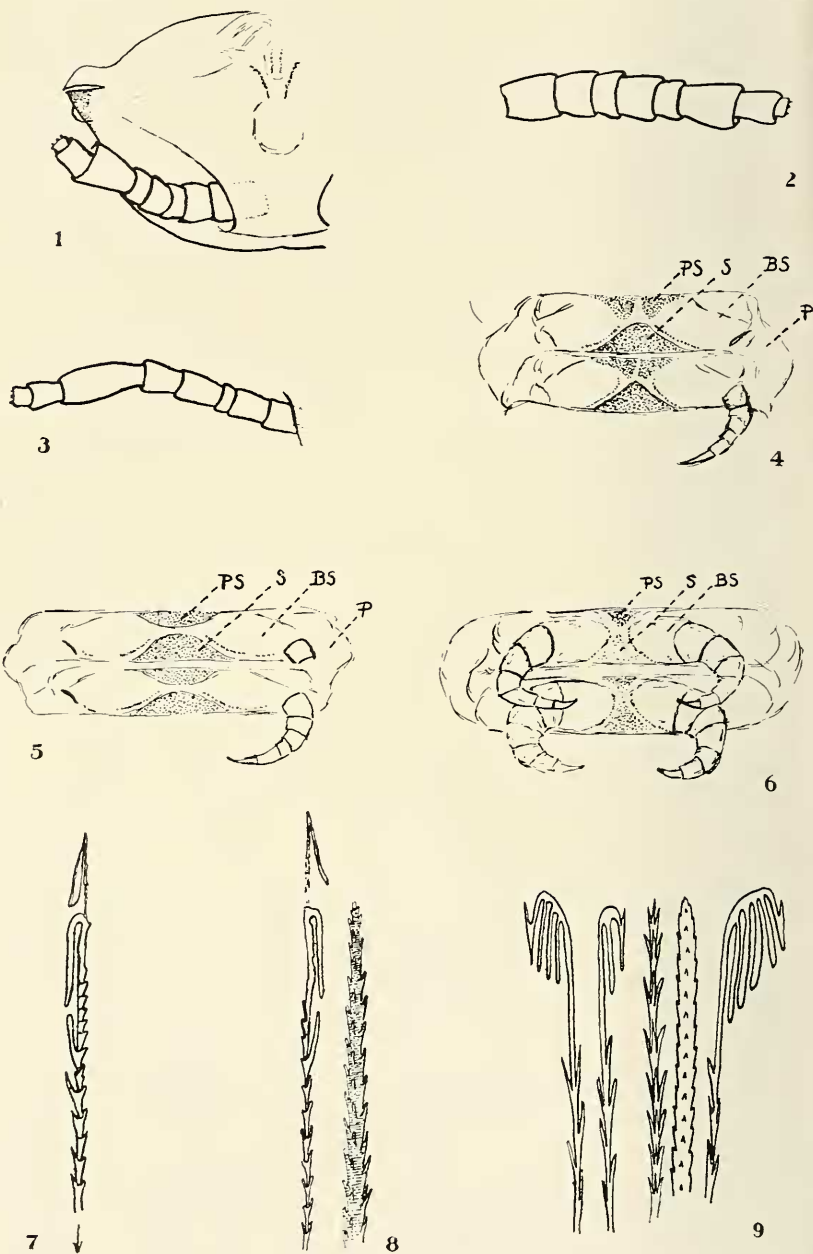
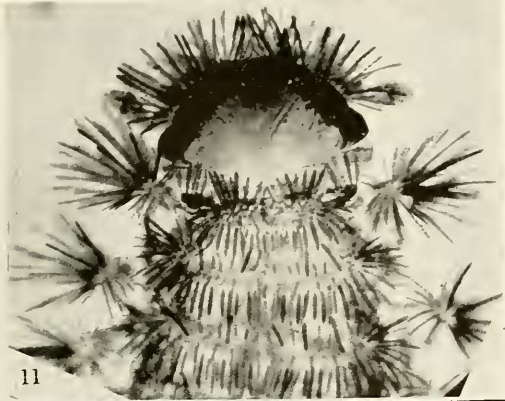


PLATE 27



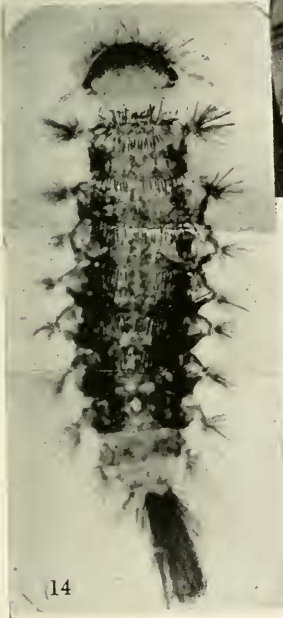
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PLATE 28

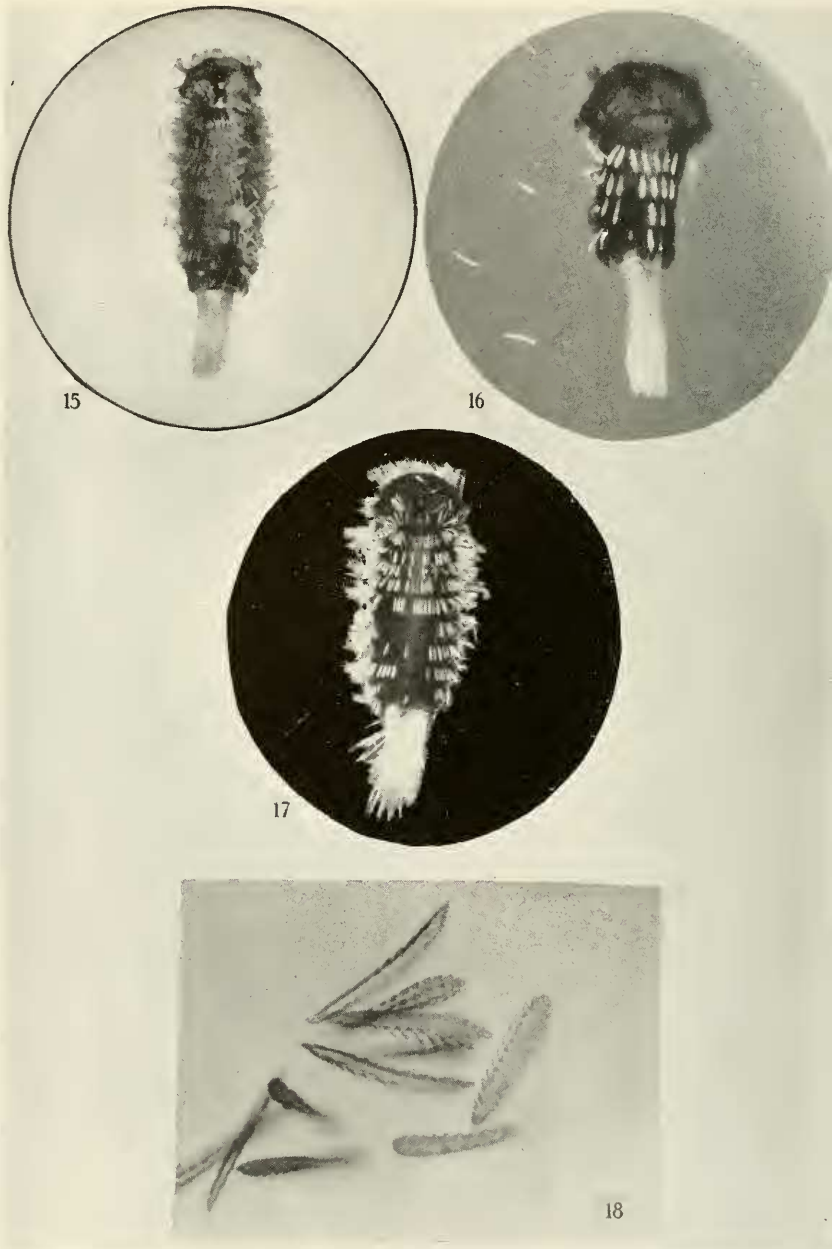


PLATE 29

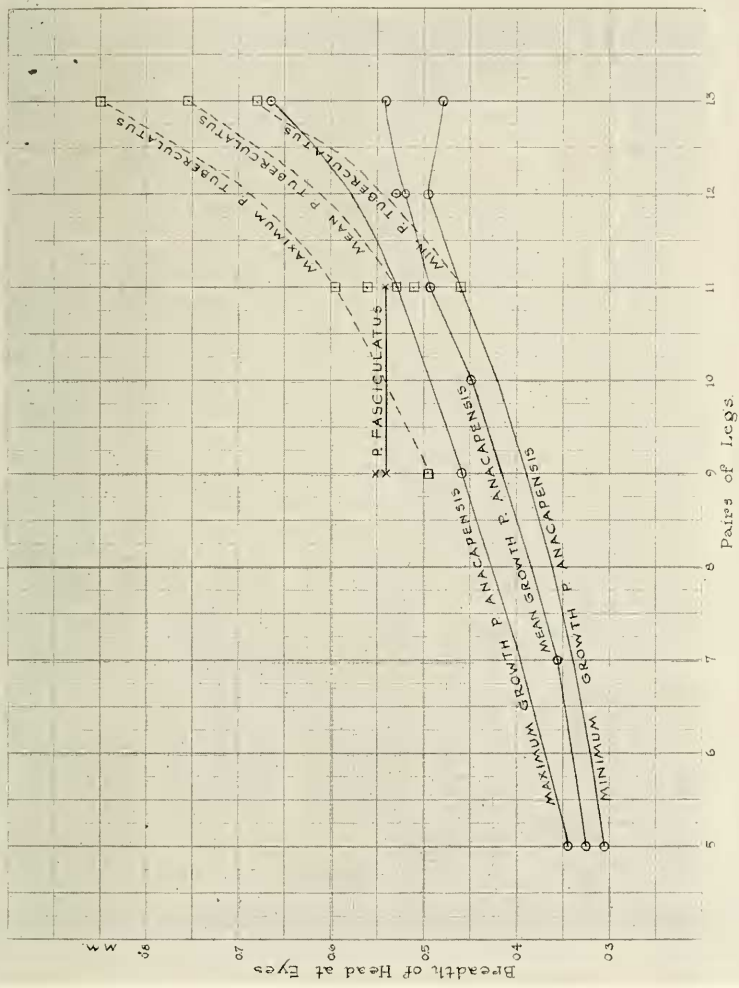


Figure 19 Correlation Between Instars and Breadth of Head. Dyar's Law

PLATE 30